

**WHAT IS CLAIMED IS:**

1        1.        A method of utilizing discrete devices in a wellbore wherein a working fluid  
2        provides fluid flow path for moving said discrete devices from a first location of  
3        introduction of said devices into the flow path to a second location of interest, said  
4        method comprising:

- 5                -        selecting at least one flowable discrete device constituting a data  
6                        carrier that is adapted to be moved in the wellbore at least in part by  
7                        the working fluid ("flowable device");
- 8                -        introducing the at least one flowable discrete device into the fluid flow  
9                        path at the first location to cause the working fluid to move the at least  
10                       one flowable device to the second location of interest; and
- 11               -        providing a data exchange device in the fluid flow path for effecting  
12                       data exchange with the at least one flowable discrete device.

1        2.        The method of claim 1, wherein selecting the at least one flowable device  
2        comprises selecting the at least one flowable device from a group consisting of: (i)  
3        a device having a sensor for providing a measure of a parameter of interest; (ii) a  
4        device having a memory for storing data therein; (iii) a device carrying energy that  
5        is transmittable to another device; (iv) a solid mass carrying a chemical that alters  
6        a state when said solid mass encounters a particular property in the wellbore; (v) a

7 device carrying a biological mass; (vi) a data recording device; (vii) a device that is  
8 adapted to take a mechanical action, and (viii) a self-charging device due to  
9 interaction with the working fluid in the wellbore.

1 3. The method of claim 1, wherein said selecting the at least one flowable  
2 device comprises selecting a device that provides a measure of a parameter of  
3 interest selected from a group consisting of: (i) pressure; (ii) temperature; (iii) flow  
4 rate; (iv) vibration; (v) presence of a particular chemical in the wellbore; (vi)  
5 viscosity; (vii) water saturation; (viii) composition of a material; (ix) corrosion; (x)  
6 velocity; (xi) a physical dimension; and (xi) deposition of a particular matter in a fluid.

1 4. The method of claim 1, wherein selecting at least one flowable device  
2 comprises selecting a device that comprises:

- 3 - a sensor for providing a measurement representative of a parameter  
4 of interest;
- 5 - a memory for storing data relating at least in part to the parameter of  
6 interest;
- 7 - a source of power for supplying power to a component of said  
8 flowable device; and
- 9 - a controller for determining data to be carried by said memory.

1        5.        The method according to claim 4 further comprising providing a transmitter  
2        for the at least one flowable device for effecting data exchange with the flowable  
3        device.

1        6.        The method of claim 5, wherein effecting the data exchange comprises  
2        communicating with said at least one flowable device by a method selected from a  
3        group consisting of: (i) electromagnetic radiation; (ii) optical signals; and (iii) acoustic  
4        signals.

1        7.        The method of claim 1, wherein selecting the at least one flowable device  
2        comprises selecting a flowable device that is adapted to carry data that is one of (i)  
3        prerecorded on the at least one flowable device; (ii) recorded on the at least one  
4        flowable device downhole; (iii) self recorded by the at least one flowable device; (iv)  
5        inferred by a change of a state associated with the at least one flowable device.

1        8.        The method of claim 1, wherein selecting the at least one flowable comprises  
2        selecting a device from a group of devices consisting of: (i) a device that is freely  
3        movable by the working fluid; (ii) a device that has variable buoyancy; (iii) a device  
4        that includes a propulsion mechanism that aids the at least one flowable device to

5 flow within the working fluid; (iv) a device that is movable within by a superimposed  
6 field; and (v) a device whose movement in the working fluid is aided by the  
7 gravitational field.

1 9. The method of claim 1, wherein selecting the at least one flowable device  
2 comprises selecting a device that is one of: (i) resistant to wellbore temperatures;  
3 (ii) resistant to chemicals; (iii) resistant to pressures in wellbores; (iv) vibration  
4 resistant; (v) impact resistant; (vi) resistant to electromagnetic radiation; (vii)  
5 resistant to electrical noise; and (viii) resistant to nuclear fields.

1 10. The method of claim 1, wherein said introducing the at least one flowable  
2 device into the working fluid further comprises delivering the at least one flowable  
3 device to the working fluid by one of (i) an isolated flow path; (ii) a chemical injection  
4 line; (iii) a tubing in a wellbore; (iv) a hydraulic line reaching the second location of  
5 interest and returning to the surface; (v) through a drill string carrying drilling fluid;  
6 (vi) through an annulus between a drill string and the wellbore; (vii) through a tubing  
7 disposed outside a drill string; and (viii) in a container that is adapted to release said  
8 at least one flowable device in the wellbore.

1 11. The method of claim 1 further comprising recovering said at least one  
2 flowable device.

1        12.    The method of claim 14, wherein recovering the at least one flowable device  
2        comprises recovering the at least one flowable device by one of (i) fluid to solid  
3        separation; and (ii) fluid to fluid separation.

1        13.    The method of claim 1, wherein said introducing the at least one flowable  
2        device includes introducing a plurality of flowable devices each such flowable device  
3        adapted to perform at least one task.

1        14.    The method of claim 13, wherein said introducing a plurality of flowable  
2        devices comprises one of (i) timed release; (ii) time independent release; (iii) on  
3        demand release; and (iv) event initiated release.

1        15.    The method of claim 1, wherein introducing said at least one flowable device  
2        comprises delivering a plurality of flowable devices into fluid circulating in a wellbore  
3        to cause at least a number of the flowable devices to remain in the wellbore at any  
4        given time, thereby forming a network of the flowable devices in the wellbore.

1        16.    The method of claim 15, wherein the flowable devices in said plurality of  
2        devices are adapted to communicate information with other devices, thereby  
3        forming communication network in the wellbore.

1        17.    The method of claim 1 further comprising providing a unique address to the  
2        at least one flowable device.

1        18.    The method of claim 1 further comprising providing a data communication  
2        device in the wellbore for communicating with the at least one flowable device.

1        19.    The method of claim 18 further comprising causing the data communication  
2        to exchange data with the at least one flowable device and to transmit a signal  
3        confirming said data exchange.

1        20.    The method of claim 1, wherein said selecting said at least one flowable  
2        device comprises selecting the at least one flowable device that includes a sensor  
3        that is one of (i) mechanical (ii) electrical; (iii) chemical; (iv) nuclear; and (v)  
4        biological.

1        21.    The method of claim 1 further comprising implanting a plurality of spaced  
2        apart flowable devices in said wellbore during drilling of said wellbore.

1        22.    The method of claim 7 further comprising receiving the data carried by said  
2        at least one flowable device by a downhole device and transmitting a signal in  
3        response to said received signal to a device located outside said wellbore.

1        23.    The method according to claim 22 further comprising said device outside said  
2        wellbore at a location that is one of: (i) in a lateral wellbore associated with said  
3        wellbore; (ii) a separate wellbore; (iii) at the surface; and (iv) in an injection well.

1        24.    A wellbore system utilizing at least one flowable device constituting a data  
2        carrier that is adapted to be moved by a fluid flowing in the wellbore comprising:

- 3            (a)    a forward fluid flow path associated with the wellbore for moving the  
4            at least one flowable device from a first location of introduction of the  
5            at least one flowable device into the forward fluid path to a second  
6            location of interest;
- 7            (b)    a data exchange device at the second location of interest for effecting  
8            data exchange with the at least one flowable device that is one of (i)  
9            retrieving information carried by the at least one flowable device; or  
10          (ii) inducing selected information on the at least one flowable device.

1        25.    The wellbore system of claim 24 further comprising a return fluid flow path  
2        for moving the at least one flowable device from the second location of interest to  
3        a return destination.

1        26.    The wellbore system of claim 24, wherein the first location of introduction and  
2        the return destination are at the surface.

1        27.    The wellbore system of claim 25, wherein the forward flow path is through a  
2        drill string utilized for drilling the wellbore and the return fluid flow path is an annulus  
3        between the drill string and the wellbore.

1        28.    The wellbore system of claim 25, wherein (i) the forward fluid flow path  
2        comprises a first section of a u-tube extending from the first location to the second  
3        location of interest and (ii) the return path comprises a second section of the u-tube  
4        returning to the return destination.

1        29.    The wellbore system of claim 24, wherein the second location of interest is  
2        in the wellbore and the data exchange device is located proximate said second  
3        location of interest.

1        30.    The wellbore system of claim 24 further comprising a controller for  
2        performing an operation that is one of (i) retrieving information from the at least one  
3        flowable device from the data exchange device, or (ii) causing the data exchange  
4        devices to induce a particular information onto the at least one flowable device.

1        31.    The wellbore system of claim 25 further comprising a control unit for  
2        processing data contained in the flowable device returning to the destination.



1        32.    The wellbore system of claim 30, wherein the controller performs at least one  
2        operation in response to the data retrieval from the at least one flowable device.

1        33.    A system for implanting at least one flowable device in the wall of the  
2        wellbore during drilling of the wellbore, comprising:

- 3            -        a drill string having a drill bit at end thereof for drilling the wellbore;
- 4            -        a source of drilling fluid for supplying the drilling fluid to the drill string;
- 5            -        a source for introducing at least one flowable device into the drilling  
6            fluid; and
- 7            -        an implanting device carried by the drill string uphole of the drill bit,  
8            said implanting device receiving the at least one flowable device from  
9            the drilling fluid and implanting the at least one flowable device in the  
10          wall of the wellbore.

1        34.    A method of utilizing flowable devices in a wellbore carrying a fluid from a  
2        downhole location to the surface, each flowable device constituting a data carrier  
3        and adapted to be moved by the fluid, said method comprising:

- 4            -        locating a plurality of flowable devices at a selected location in a  
5            wellbore; and
- 6            -        selectively releasing the flowable devices into fluid, thereby moving  
7            the flowable devices carry data from the selected location in the  
8            wellbore to the surface.

9 35. The method of claim 34, wherein the locating of a plurality of the flowable  
10 devices includes locating said devices in a magazine from where said devices are  
11 individually releaseable into the flow of the fluid.

1 36. The method of claim 34 further comprising providing a controller in the  
2 wellbore for inducing information n to the at flowable devices prior to their release  
3 into the fluid.

1 37. The method of claim 34, wherein the releasing the flowable devices includes  
2 at least one of (i) releasing the flowable devices at predetermined time intervals, (ii)  
3 releasing a flowable device upon the occurrence of a particular event; or (iii)  
4 releasing the flowable devices periodically.

1 38. A discrete flowable device adapted to be moved at least partially by a fluid  
2 flowing in a wellbore, comprising:

- 3 - a sensor for taking measurements relating to a wellbore parameter;
- 4 - a controller for processing the sensor measurements;
- 5 - a memory for storing data;
- 6 - a power source for supplying power to elements of the flowable
- 7 device;
- 8 - an antenna for communicating information to a device external to the
- 9 flowable device; and

10                   -       a body housing the sensor, controller, memory and the power source,  
11                        which body is adapted to protect the device from wellbore conditions.

1       39.    The discrete flowable device according to claim 38 further comprising an  
2       external member that interacts with fluid in the wellbore to aid in generating  
3       electrical energy.

1       40.    The discrete flowable device according to claim 39, wherein the electrical  
2       energy is utilized to charge the power supply.

1       41.    The discrete flowable device according to claim 38 further comprising a  
2       buoyancy device to alter the buoyancy of the discrete flowable device.

1       42.    The discrete flowable device according to claim 38 further comprising a  
2       propeller for aiding the discrete flowable device to flow in the wellbore.